The Master of Science degree in Hydrology and Water Resources requires a combination of:

- **Course Work** – Approved graduate-level course work
- **Research** – A research-based Master’s Thesis
- **Professional Development** – Development of professional-level oral presentation skills from observing research seminar presentation techniques and demonstration of one’s own skills in a seminar course (HWRS 696-series) or in a conference setting

Course Work and Research are documented in the Master’s Plan of Study (MPOS) and include:

- 12 units of Master’s-level Core Courses
- 12 units of Advanced Electives (see Primary Faculty requirement below)
- 2 units of HWRS Field Methods
- 4 units of HWRS 910 Master’s Thesis
- A seminar course from HWRS 696-series or approved seminar presentation noted in file

Professional Development is satisfied by:

- Enrollment in HWR 695A (1 unit) Wednesday Weekly Colloquium for one semester during academic residency. Student may choose semester of enrollment, although enrollment in the 695A colloquium should be completed prior to taking a 696-series seminar course or presenting a paper or poster at a regional or national conference
- Presentation of poster or paper at a conference or taking a 696-series seminar course

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**FUNDAMENTALS: MASTER’S CORE COURSES = 12 UNITS**

Core courses are not sequential and may be started in either Fall or Spring Semesters.
(The core Courses in BOLD are required, one of the others listed may be taken to complete the required 4 courses for the core)

Courses offered in Fall:

- **HWRS 517A Fundamentals of Water Quality (3) Meixner**

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1. HWR does not allow the Grade Replacement Opportunity option for any of its courses; however, your minor department may (or may not) permit GRO of course work. See the Graduate Catalog or Graduate College website for details about GRO in general; see Departments for specific rules or restrictions.
2. If you present a paper or poster at a regional or national conference to satisfy the professional development (696-series seminar requirement (no unit is awarded), you should complete 12 units of Advanced Electives, essentially 4 courses. If you do not present a paper or poster, you should complete at least 1 unit of an HWR 696-series seminar course and at least 11 units of Advanced Electives (e.g. one 4-unit course and two 3-unit courses (=10), three 3-unit courses and one 1-unit course (=10)). Independent study units may not be used to in lieu of Advanced Elective units.
• **HWRS 518 Fundamentals of Subsurface Hydrology (3) Ferré & Winter**
• **HWRS 528 Fundamentals of Systems Approach Hydrologic Modeling (3) Gupta**
• **HWRS 575 - Economic Evaluation of Water and Environmental Policy (3) Colby**
• **LAW 641 Water Law (3) Glennon**

Courses offered in Spring:

• **HWRS 519 Fundamentals of Surface Hydrology (3) Troch**
• **HWRS 576 - Natural Resource Law and Economics (3) Cory**

**ADVANCED ELECTIVES = 12 UNITS**

**PRIMARY FACULTY³ LIST**

**9 UNITS MINIMUM⁴ FROM THIS CATEGORY**

Complete at least 9 units (three courses) from this list for inclusion in the MPOS. You may complete all 12 units from this category if faculty advisor so recommends.

All courses, except those noted, use the prefix **HWRS:**

• **503 Subsurface Fluid Dynamics (3) Winter**
• **505 Vadose Zone Hydrology (3) Ferré**
• **516 Hydrologic Transport Processes (3) Yeh**
• **521 Water Resources Systems Planning and Management (3) Valdés/Maddock**
• **524 Hydroclimatolgy (3) Niu**
• **531 Hydrogeology (4) 3 units LEC & 1 unit LAB Zreda**
• **532 Environmental Hydrogeo (3) 3-unit LAB Zreda**
• **535 Advanced Subsurface Hydrology (3) Yeh**
• **543A Environmental Risk-Econ Analysis Water Res (3) Winter**
• **549 Statistical Hydrology (3) Valdés**
• **GEOS 553 Glacial and Quaternary Geology (3) *Exception to cross-listed rule; GEOS is home* Baker**
• **570 Computer Simulation Water Quality Proc (3) Meixner**
• **GC/HWRS 572 Global Biogeochemical Cycles (3) *Exception to cross-listed rule; GC is home* Leavitt**
• **580 Isotope Tracers in Hydrogeology (3) McIntosh**
• **582 Applied Groundwater Modeling (3) Maddock**

³ Primary Faculty members include Baker, Ferré, Gupta, Maddock, McIntosh, Meixner, Niu, Troch, Valdés, Yeh, Winter, and Zreda. A “Primary” course is one in which the Primary Faculty teaching load is 50% or more. Courses with multiple instructors where less than 50% is taught by a Primary Faculty member not included in the Primary Faculty category.

⁴ No less than 6 units must be completed from this list. Independent study units may not be used in lieu of a 3-unit course. 3 units of an advanced elective course not listed here may be approved in advance by a letter of petition to department head via academic advisor for inclusion in the MPOS. Attach a completed MPOS form.
• 596M Application & Theory Decision Support Models (3) Washburne/Tidwell
• 603A Well Hydraulics & Pumping Test Analysis (3) Yeh
• 630 Advanced Catchment Hydrology (3) Troch
• 642 Analysis of Hydrologic Systems (3) Gupta
• 645 Stochastic Methods Subsurface Hydro (3) YEH
• 655 Stochastic Methods Surface Hydro (3) Gupta/Valdés
• HWRS 696-Series Seminar Courses (see section below), e.g. 696 B, C, F, G, H, I, L, T

PRE-APPROVED NON-HWR LIST
3 UNITS MAXIMUM FROM THIS CATEGORY

You may include only 3 units (one course) from this category on the MPOS. No petition will be required. Graduate-Level Only Course List: Courses listed in this category must be taught only at the graduate level and may not be taught as a 400- and 500-level course. Courses listed in numerical (not alphabetical) order.

ATMO/HWRS 529 Objective Analysis in Atmospheric and Related Sciences
ATMO/HWRS 558 Mesoscale Meteorological Modeling (3)
SWES/HWRS 566 Soil and Groundwater Remediation (3)
AREC/HWRS 577 Advanced Topics Economic Environmental Regulation (3)
PA/HWRS 581 Environmental Policy (3) *Exception to co-convened rule when taught separately (i.e. 481 Fall, 581 Spring)*
ATMO/HWRS 595B Global Climate Change Colloquium (3)
ATMO/HWRS 595C General Circulation Observations-Modeling (1-3)
SWES/HWRS/LAW 596B Arizona Water Policy (3) If enrolled as LAW, permission and registration through College of Law
GEOG/HWRS 596K Risk and Society (3)
SWES/HWRS 605 Soil-Water Dynamics (3)
SWES/HWRS 625 Physical Characterization in Monitoring the Critical Zone (3)
LAW 606 Constitutional Law I (3) Permission to enroll and register through College of Law
WSM/SWES 696M MATLAB Data Processing (3)
SWES/HWRS 696Q Practical and Applied Meteorology (1-3)

COURSES NOT PRE-APPROVED

Courses listed below are not automatically approved for the MPOS. This list includes:

- Courses that may be cross-listed with HWRS but HWRS is not the Home Department
- Courses that are co-convened (i.e. taught at the 400- and 500-levels and include undergraduates—juniors and seniors—as well as graduate students)

A course on the following list is not automatically approved for inclusion in a Master’s Plan of Study, regardless of whether it has been approved for another student. Plans of Study are
highly individualized and may be based on prior education, professional experience, or other criteria. Seek the advice of your faculty advisor and the departmental academic advisor if you wish to include one course on your MPOS. If you do:

- A letter of petition will be required in advance
- Allow 3-4 weeks for review, especially if fall or spring classes are not yet in session
- No more than one course from this list that has been approved by petition may be included in the MPOS
- When a course is approved from this list, it replaces the allowable 3-unit course from the Pre-Approved Non-HWR list
- You may take additional courses from this list; however, they will not be included in the MPOS
- Courses from this list may be eligible for use on the Doctoral Plan of Study (consult with the academic advisor)

**LIST OF COURSES NOT AUTOMATICALLY APPROVED FOR MPOS**

- RNR 417-517 Geographic Information Systems for Natural and Social Sciences (3)
- CE/HWR 423-523 Hydrology (3)
- CE/HWR 427-527 Computer Applications in Hydraulics (3)
- ATMO/HWR 436A-536A Fundamentals of Atmospheric Sciences (3)
- GEOS 439A-539A Introduction to Dendrochronology (4)
- GEOS 450-550 Geomorphology (4)
- WSM/HWR 452-552 Dryland Ecohydrology and Vegetation Dynamics (3)
- WSM/HWR 456A-556A Watersheds and Ecosystem Function (3)
- WSM/HWR 460-560 Watershed Hydrology (3)
- SWES/HWR 464-564 Environmental Chemistry (3)
- WSM/HWR 467-567 Advanced Watershed Hydrology (3)
- RNR/HWR 473-573 Spatial Analysis and Modeling (3)
- GEOS/HWR 478-578 Global Change (3)
- GEOG 483-583 Geographic Applications of Remote Sensing (3)
- REM/HWR 490-590 Remote Sensing for Study of Planet Earth (3)

**FIELD METHODS = 2 UNITS**

The HWRS field methods course is required for all students and may be satisfied as follows:

- HWRS 513A (2) Meixner/Ferré SPRING
- A field camp experience in Geology does not routinely satisfy this requirement
- Submit a Letter of Petition requesting waiver of requirement (details follow)
  - Address to department head, submit via academic advisor
  - **No** academic credit, no units, no grade awarded
• Letter of Petition used primarily by students with extensive field campaign experience through long-term employment in consulting or a governmental agency (e.g. USGS, AZGS, EPA/DOE, USDA ARS, national laboratories)
• Letter of Petition requires detailed documentation of prior experience or activities, description of job duties, skills, and appropriate contact information for supervisor of field work
• You may need to replace unit(s) with other coursework to meet minimum 30-unit requirement

PROFESSIONAL DEVELOPMENT = 1 UNIT [See note regarding Plan of Study]

You must enroll in HWRS 695A (1 unit), the Wednesday Weekly Colloquium, for one semester during academic residency. **Do not include this unit on your Master’s Plan of Study.**

MASTER’S THESIS = 4 UNITS TOTAL

Enroll for primary faculty supervisor’s individual section number of HWRS 910 Thesis. Enrollment is available only through academic advisor’s office. You may enroll for all 4 units during the same semester or split enrollment over several semesters.

696-SERIES SEMINAR = 1 UNIT MINIMUM

696-Series Seminar Courses are special advanced topic courses. A Master’s level student is expected to develop basic competence using oral presentation techniques demonstrated in these seminar courses and in the Professional Development activity (695A Weekly Colloquium). You may satisfy this requirement by completing an HWR 696-series seminar course or by Letter of Petition (see note below). Courses may vary by section number or semester of offering.

• 696B Advanced Topics Hydrology-Biogeochemistry Interactions
• 696C Advanced Topics in Subsurface Hydrology and Modeling
• 696F Advanced Topics in Surface Hydrology and Modeling
• 696G Water-Rock-Microbial Interactions
• 696H Advanced Topics in Geochemistry of Crustal Fluids
• 696I Advanced Topics in Pore-Scale Processes
• 696L Topics in Semi-Arid Hydrology
• 696T Cosmogenic Isotopes and Other Environmental Tracers

Submit Letter of Petition (addressed to department head) to request acceptance of a presentation (paper or poster)—based on your thesis research—at an approved conference
• No academic credit (units or a grade) awarded for conference presentation
• You may need to replace unit(s) with other course work to meet the minimum unit requirement for the MS degree